PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-327704

(43)Date of publication of application : 29.11.1994

(51)Int.Cl. A61C 13/20
B22C 9/04
B28B 1/52

(21)Application number : 05-139524

(22)Date of filing : 18.05.1993

(71)Applicant : MAEDA SHINICHI
NIPPON MUKI CO LTD

(72)Inventor : MAEDA TAKASHI
MIYASHITA SEI

(54) RING LINING MATERIAL FOR DENTAL CASTING

(57)Abstract:

PURPOSE: To make it possible to execute exact dental casting which does not hinder expansion on curing and thermal expansion by providing at least one surface of a sheet essentially consisting of ceramic fibers with a hydrophobic film, thereby improving touch to hand and operability and obviating the generation of a change in the ratio to mixing water.

CONSTITUTION: At least one surface of the sheet essentially consisting of ceramic fibers is provided with th hydrophobic film and the hydrophobic film is formed out of a synthetic resin film stuck to a sheet. This ring lining material for dental casting does not contain asbestos at all and gas sufficient heat resistance and cushion resistance of a ceramic sheet and the sure water repellency and smoothness of the hydrophobic film in combination. The touch to hand at the time of mounting the ring lining material by the hydrophobic film is good and the water in investment compd. mud is surely shut off and, therefore, the sure control of the expansion ratio on curing of the investment compd. without allowing the lining material to absorb water and without changing the ratio to mixing water. Water floating and dent to not arise, either. The adaptibility to the defective fulcrum of the restored matter by casting is good.

LEGAL STATUS

[Date of request for examination] 17.03.2000

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3710144

[Date of registration] 19.08.2005

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The ring liner for dental casting characterized by preparing the hydrophobic film at least in one side of the she which uses ceramic fiber as a principal component.
[Claim 2] Said hydrophobic film is a ring liner for dental casting according to claim 1 characterized by being the synthetic-resin film stuck on said sheet.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the ring liner for dental casting which carries out the lining inside a casting ring and which is used for it in dental casting.
[0002]
[Description of the Prior Art] It is used for it as a cushioning material for compensating the contraction produced in case the molten metal cast by the ring for dental casting is cooled by even the room temperature, carrying out the lining of th ring liner for dental casting inside the ring for dental casting. Conventionally, the asbestos ribbon which cut out the asbestos paper which uses asbestos as a principal component as this kind of a ring liner in the shape of a strip of paper is used, and the ceramic paper which recently uses ceramic fiber, such as a silica alumina fiber, as a principal component i part came to be used.
[0003] Although an alloy is cast and an inlay, crown, the metal base, the bar for casting, the clasp for casting, etc. are produced when restoring the gear tooth (cavity) which fell ill by the caries with dentistry, and the gear tooth which fell out, the precision casting called a lost wax process on the occasion of casting is used. When this is inaccurate, it is because a patient's gear tooth cannot be certainly equipped with an inlay, crown, etc. which were cast.
[0004] However, since it will contract about 1.5 to 2.3% by the time it is cooled by ordinary temperature after solidifyin a dental alloy in mold (invetment) also with a lost wax process, the invetment needs to carry out only expansion which compensates contraction of a casting alloy during coagulation hardening and heating. The mold at the time of casting th molten metal of an alloy needs to be larger about 1.5 to 2.3% than the dimension of a wax pattern, and, for this reason, t invetment carries out the setting expansion and thermal expansion. The invetment makes the pattern formed with the wa into the casting ring buried, carries out heating dewaxing of the invetment within an electric furnace after coagulation hardening, and forms mold.
[0005] Therefore, the ring liner which absorbs expansion of the invetment to the inner skin of a casting ring is prepared. The lining of this ring liner is carried out to the inner skin of a casting ring in the shape of a strip of paper. Therefore, to have the cushioning properties which control and absorb fitting a casting ring, and the setting expansion at the time of th coagulation of the invetment and the thermal expansion at the time of heating, and for the heated ring liner to maintain t shape of a sheet, and not to collapse in the shape of cotton are demanded. As a material which fills such a demand, the asbestos ribbon has been used conventionally.
[0006] In an actual dental casting activity, the absorptivity of a ring liner turns into an important property. That is, in the activity in which a wax pattern is made buried by the invetment, it mixes by the weight ratio which had invetment powd and water decided just before an activity, and the invetment of the shape of mud acquired by doing in this way is poured out in the ring which carried out the interior of the liner. Then, it is left in ordinary temperature and coagulation hardeni of the invetment is carried out. At this time, the approach which is not made to include the approach of including water a liner just before pouring out the invetment for a "wet method" and water, but is poured out as it is is called "dry process." By the way, if a mixing water ratio changes when the moisture in the invetment absorbs water to a liner, after filling a ring with the invetment before carrying out coagulation hardening, it will have effect which were enumerated below on a casting property or casting nature.
(1) The mixing water ratio of the invetment changes with water absorption of a liner, and the expansion coefficient at th time of coagulation hardening changes.
(2) The mixing water ratio of the invetment changes with water absorption of a liner partially, and produce a crack at th time of coagulation hardening.
(3) If the water absorption rate of a liner is quick, casting nature besides the fault stated by (1) and (2) will also worsen. That is, in a wet method, if water superfluous when the water absorption rate of a liner is quick, and water is included beforehand is absorbed and the invetment expands, a liner will be compressed and the so-called "water float" by which film of water is made on discharge and an invetment up front face will generate the included water. The time amount of

coagulation hardening becomes long by this, and working hours become long. Moreover, in dry process, the water in the invetment is absorbed superfluously, an impression is generated in the center of the invetment, and the so-called "crater" occurs. This "crater" is cratered in the shape of a half moon in many cases.
(4) Although a "crater" occurs too since moisture is gradually absorbed while the invetment carries out coagulation hardening also when a water absorption rate is slow although a liner absorbs water, this "crater" becomes deep to a wedg shape, the invetment layer of the wax pattern upper part becomes thin, and it becomes the cause of breakage.
[0007] Although there is absorptivity also in the asbestos ribbon currently conventionally used as a liner, consistencies a 0.8 g/cm3. Extent and since it is comparatively high, the absorptivity is not strong. About 15 - 40 seconds are taken to permeate as a numeric value showing absorptivity, if 0.5 cc water is dropped at an asbestos ribbon. Since an asbestos ribbon has such absorptivity, before pouring in the invetment so that the moisture of the invetment may not be absorbed too much in a dental casting activity, moisture is included beforehand. Moreover, if moisture is included too much, since "water float" will be generated, it is adjusting so that it may become moderate water content. An actual activity is underwater immersed for 1 - 2 seconds in an asbestos ribbon. Thus, if invetment mud is poured out after carrying out water beforehand, there will be "few craters" and they will serve as a good coagulation hardening activity without a "water float." Conventionally, such an approach is taken widely and it was working with the "wet method." However, a wet method is the working method devised as not changing the mixing water ratio of the invetment as much as possible when using asbestos for a liner, and is the technique accompanied by dispersion in a mixing water ratio fundamentally. That is, since an asbestos ribbon has absorptivity, if the invetment is poured in, moisture will be taken by asbestos and th mixing water ratio of the invetment will change. Then, he is trying not to change a mixing water ratio by including moisture in asbestos beforehand. However, there are many places for which there is dispersion also in the absorptivity of an asbestos ribbon and it depends on experience of a dental technician or a can.
[0008] On the other hand, by abolishing the absorptivity of a ring liner and considering as water repellence, receipts and payments of water are eliminated, the mixing water ratio of the invetment is not changed, there is also an idea of saying that exact casting will be performed, contrary to a wet method, and such an approach is "dry process." In this case, vaseline was applied to the asbestos ribbon, or water proofing was performed to it by the silicone spray etc., and it has been coped with. However, the activity of such water-repellent grant is complicated, and when using an asbestos ribbon, has almost been performed with the wet method.
[0009] Thus, although the asbestos ribbon has been used in dental casting more widely than before, in U.S. inside, the us to a building material is forbidden by the thing that asbestos has carcinogenic, and regulating also in Japan etc. has become a social problem in recent years. Requests into the ingredient which replaces asbestos also in dentistry have beer mounting. Thus, the ceramic fiber system ring liner which does not use asbestos and which used alumina silica system fiber as the principal component has also come to be marketed.
[0010] These ceramic fiber system liners use ceramic fiber and rock wool as a principal component, and are using synthetic resin or natural pulp, such as acrylic resin, as the binder. Generally the consistencies of a ceramic sheet are 0.4 g/cm3. As compared with an asbestos ribbon, cushioning properties are good below, and neither the setting expansion at the time of the coagulation of the invetment nor the thermal expansion at the time of heating is controlled also by thickness thinner than the conventional asbestos ribbon. moreover, there is an advantage, like thermal resistance also comes out enough and there is.
[0011] If the inorganic fiber itself, such as ceramic fiber, rock wool, and a glass fiber, will be a hydrophilic property, the binder to be used will become with the liner of a hydrophilic property (absorptivity) in the case of hydrophilic ingredien such as natural pulp, if its attention is paid to the field of absorptivity, and water-repellent ingredients, such as synthetic resin, are used, according to the amount, the degree of water repellence [liner] will become strong. Generally the consistencies of a ceramic sheet are 0.4 g/cm3, as mentioned already. It is 1/2 or less [of the following and an asbestos ribbon], and if the absorptivity when not using a water-repellent ingredient is very large and waterdrop is dropped, it wi permeate in an instant. Moreover, when immersed in water, it absorbs water more than the 300 weight sections to the amount of Motoshige in an instant mostly. Therefore, when the large sheet of such absorptivity is made into a ring liner, invetment mud is poured out in a wet method, a "water float" will be generated and a "crater" will be produced in dry process. When using synthetic resin for an organic binder, water repellence becomes strong, so that there are many synthetic-resin additions. In order to obtain required labor strength and to usually add more than 5 weight sections, the ring liner of synthetic-resin use has low absorptivity. When extent of absorptivity does not absorb water mostly, it is usable at both wet and dry type, but when absorbing water slightly, especially in dry process, it becomes easy to generat a "crater." Then, in order to give the water repellence stabilized so that water might hardly be absorbed, there are some which are carrying out water repellent processing of a silicone system or a fluorine system. Since the ceramic system lir which has these water repellence is excellent in thermal resistance and cushioning properties and has water repellence, i is the outstanding ring liner to which the mixing water ratio of the invetment is not changed.
[0012]
[Problem(s) to be Solved by the Invention] Although there is not only no asbestine harmful nature, but the engine

performance as a ring liner has been progressing compared with the conventional asbestos ribbon, the ceramic system liner in recent years also has the following technical problems, as described above.
(1) Although water repellence is given by the conventional water-repellent ceramic system liner, it is not completeness, and although it is small, in order to absorb water, produce about 1-2mm a "crater" in casting. It is better not to produce a "crater" ideally, although faults, such as a casting defect, hardly occur in the amount of craters of this amount.
(2) With a ceramic sheet with a porous front face, the setting expansion at the time of the coagulation of the invetment, especially the invetment with a precise particle size may be controlled. Although a mixing water ratio does not change since there is no migration of moisture when water repellence is given to a ceramic sheet, ceramic fiber or the diameter c fiber of rock wool is about 3-6 micrometers, and the opening between fiber is still larger and turns into an opening 50 micrometers or more in a large part. Moreover, even when inorganic fine particles, such as alumina powder, are mixed, a about 30-micrometer opening is produced everywhere. On the other hand, a particle with the thing of the gypsum-fibrosum system by which the grain size of the invetment is generally marketed finer than 50 micrometers occupies 90% or more. The particle smaller than the opening on the front face of a sheet in it serves as a ceramic sheet and a form whic eats away between the ceramic fiber of the sheet surface section in the interface of the invetment. Although the invetmer carries out the setting expansion, if there is no adhesion firmly and it is caught when a particle eats into a liner, expansio will be controlled and a predetermined expansion coefficient will be obtained. As mentioned above, in order to carry out precision casting, the expansion coefficient of the invetment is designed so that contraction of an alloy may be suited. Therefore, the invetment should be expanded as a design. Also when expansion is controlled by adhesion of this liner an the invetment, poor adaptation hardly results, but in order that the invetment of these days may acquire a casting side [****], it is thought that it is tended further carry out eburnation of the grain size of the invetment, it increases conventionally, and adhesion of this liner and the invetment and the problem of connection become large. The ring liner to which the contact surface with the invetment is smooth, loses adhesion of an invetment particle and connection, and thus, it not only gives water repellence to a liner, but it does not control expansion is called for.
(3) It is that a feel is [the ceramic system liner of the former / fault / 3rd] bad. An early ceramic sheet has some to whic a shot is removed and a feel is becoming good comparatively in recent years, although many shots felt rough. However, good feel like the usual paper of fine quality is not obtained. Although it pushed against the ring with the finger so that t inner skin and the liner of a ring might fit when using a liner, at that time, a feel is bad and the conventional ceramic she had bad operability.
[0013]
[Means for Solving the Problem] the thermal resistance which was excellent in the ceramic sheet when the ring liner for dental casting of this invention prepared the hydrophobic film at least in one side of the sheet which uses ceramic fiber a a principal component, cushioning properties, and the positive water repellence by the hydrophobic film and surface smooth nature -- combining -- ** -- it is a thing.
[0014] About the ceramic sheet used as a base material, by dental casting, in case heating dewaxing of the wax pattern i carried out, in order to heat at 700-800 degrees C with an electric furnace, ceramic fiber with a heat-resistant temperatur of 1000 degrees C or more is used as the heat-resistant aggregate. As an inorganic fiber which has the thermal resistance of 1000 degrees C or more, they are aluminum 2O3 / SiO2. A weight ratio can use an alumina fiber besides the ceramic fiber of 0.4-0.6, a zirconia fiber, milt fiber, and a potassium titanate fiber. Or rock wool with a heat-resistant temperatur of 700-800 degrees C may be blended with this. Furthermore, the inorganic fine particles which make a glass fiber and alumina powder representation for the reinforcement on the strength after disappearance of an organic binder may be blended at the time of heating. The loadings of the ceramic fiber used as the aggregate are required for more than 30 weight sections.
[0015] Although hydrophobic synthetic-resin emulsions, such as a natural binder of hydrophilic properties, such as detailed cellulose fiber, CMC, and gelatin, and acrylic resin, and vinyl acetate resin, can be used as an organic binder fo obtaining labor strength, especially if it is the binder with which required labor strength is obtained, it will not be limite to these. a binder (the minimum coat formation temperature) soft in order to consider as a flexible liner especially, for example, MFT, -- an acrylic emulsion 0 degree C or less and a plasticizer -- the vinyl acetate emulsion whose mixing ra is about 50% is suitable, and 5 - 20 weight section is suitable for the loadings. In addition, it may use together with synthetic resin as an organic material, the natural pulp currently used from the former may be blended, and flexible aesthetic property may be taken out.
[0016] As hydrophobic film prepared at least in one side of the sheet fabricated by the above ingredient combination, hydrophobic synthetic-resin films, such as polyethylene, polypropylene, polystyrene, a polyvinyl chloride, a polyvinylidene chloride, polyvinyl alcohol (hydrophobicity), a fluororesin, a polycarbonate, acetate, polyester, and a polyamide, may be stuck by adhesives or thermal melting arrival, and the paste of natural rubber latex, synthetic rubber latex, a synthetic-resin latex, etc. may be applied. If it says from a manufacture side, it is efficient to align the melting sheet of a thermoplastics film with a ceramic sheet, to film-ize resin and to stick it with a cold press. Moreover, if it say from a presentation, since it will be burned down by organic [the amount of] at a heating dewaxing process by dental

casting, what does not generate harmful gas, such as chlorine gas, or does not generate a nasty smell, a lot of smoke, etc. is desirable in that case. The thinner one of the thickness of the hydrophobic film is good in the range which can secure water repellence and smooth nature. That is, since it is important as requirements other than water repellence and smooth nature not to check the flexibility of the whole liner, to harness the cushioning properties of the ceramic sheet used as a base material in the maximum, and to lessen a burned down part at the time of incineration as much as possible, the thinner one is good, but about 5-30 micrometers is desirable so that neither a pinhole nor a gash may occur at the time of lamination processing. Moreover, said canal **** may be carried out as [prepare / not only in one side of a sheet but in both sides], and may be constituted in ring inner skin and the made reversible type ring liner also in respect of which. Furthermore, if said canal **** is processed into saccate and it enables it to also cover the end face of a sheet again, sinc it can prevent completely that the moisture of the invetment infiltrates into a sheet and the absorptivity of the sheet itself and water repellence will not pose a problem in it, degrees of freedom of selection, such as a presentation of an organic binder and coating weight, can be extended.

[0017]

[Function] If the ring liner which produced the sheet on the above conditions and prepared the hydrophobic film at least the one side, i.e., the field in contact with the invetment, is used, since a film is in the field of the side forced with a finge in order to make ring inner skin fit, a feel is good, and operability is good. Next, change of a mixing water ratio does not arise but the invetment can perform exact dental casting which does not bar the setting expansion and thermal expansion That is, a mixing water ratio is not changed, without a liner absorbing water, in order to intercept the water in invetment mud certainly and completely with the thin hydrophobic film prepared in the field in contact with the invetment. Therefore, the rate of the setting expansion of the invetment is correctly controllable. Moreover, since there is no migration of moisture between a ring liner and the invetment and a water float and a crater do not occur, an efficient activity can be done, and there is also no risk of invetment layer breakage of the wax pattern upper part. Expansion as a design can be carried out without controlling expansion of an invetment particle by the cushioning properties which excelled [setting expansion / of the invetment] in the ceramic sheet used as a base material, and the smooth nature of th hydrophobic film. Moreover, also in case heating incineration of the wax pattern is carried out with an electric furnace, heating expansion of the invetment is not controlled. As mentioned above, if the ring liner by this invention is used, dent casting with it can be performed. [good and workability and] [exact]

[0018]

[Example] Next, the example of this invention is explained with the example of a comparison.

(Example 1) The ceramic fiber 40 weight section, the glass fiber 20 weight section, the alumina powder 30 weight sectic and the kraft pulp (NBKP) 10 weight section are disaggregated underwater. The acrylic resin 7 weight section and also a polymer coagulant were added to this, and by the usual approach, paper making was carried out, it dried, and the sheet with a thickness of 0.65mm was produced. Dipping of this was carried out to the fluorine water repellent solution 0.2%, and it dried. Next, a melting polyethylene sheet is set by one side of the obtained sheet, polyethylene is film-ized with a cold press, and the ceramic sheet and the polyethylene film were stuck. In addition, the thickness of the stuck polyethylene film was 10 micrometers. This was made into Sample A.

[0019] (Example 2) The ceramic fiber 30 weight section, the glass fiber 20 weight section, the aluminum powder 30 weight section, and the kraft pulp (NBKP) 20 weight section are disaggregated underwater. The detailed cellulose fiber weight section and also a polymer coagulant were added to this, and by the usual approach, paper making was carried o it dried, and the sheet with a thickness of 0.65mm was obtained. Next, an organic adhesives spray is applied to one side the obtained sheet, and the ethylene vinyl acetate copolymer film with a thickness of 15 micrometers was stuck on it. Tl was made into Sample B.

[0020] (Example 3) The ceramic fiber 60 weight section, the glass fiber 20 weight section, and the alumina powder 20 weight section are disaggregated underwater. The vinyl acetate resin 15 weight section and also a polymer coagulant we added to this, and by the usual approach, paper making was carried out, it dried, and the sheet with a thickness of 0.65m was produced. Next, the hydrophobic Vinylon film with a thickness of 20 micrometers was stuck on one side of the obtained sheet by thermal melting arrival. This was made into Sample C.

[0021] (Example 1 of a comparison) With the same combination as an example 1, and a procedure, the sheet with a thickness of 0.65mm was obtained and this was made into Sample D.

[0022] (Example 2 of a comparison) The sheet with a thickness of 0.65mm was obtained with the same combination as example 2, and a procedure, and this was made into Sample E.

[0023] (Example 3 of a comparison) The sheet with a thickness of 0.65mm was obtained with the same combination as example 3, and a procedure, and this was made into Sample F.

[0024] Next, each obtained sample was used as a ring liner, it cast in both dry type casting and wet casting, desiccation the invetment, the "water float" at the time of coagulation, and extent of a "crater" were measured, the goodness of fit o casting object was measured further, and the good of adaptation and a defect were evaluated. Furthermore, absorptivity is the absorptivity by the side of the hydrophobic film which has the hydrophobic film) of a sample sheet own [each] v

also measured, and the result was shown in Table 1. In addition, a test method is shown below.
(1).Judge a sample in width of face of 35mm, and die length of 89mm, and carry out the lining inside a casting ring with height [of 35mm], and a bore [phi] of 29mm. It is made for the side to which the sample which prepared the hydrophobic film touches the invetment to serve as hydrophobic film. When casting in a wet method, it is easy to be immersed in water for 1 second the whole ring, it shakes at about 1 quota of the invetment impregnation stated by following (3), and redundant water is cut.
(2) Fix the casting ring which carried out the lining of the sample to the truncated cone which stood the established crown mold wax pattern erect.
(3) still more proper in invetment powder and water -- mix so that it may become a mixing ratio, pour in into a ring the invetment elaborated in the shape of a cream, and embed a wax pattern. In addition, the invetment used the plaster bonding investment material of a mixing water ratio (water/invetment) 0.38.
(4) Measure the time amount (time amount until the water of an invetment up front face disappears) taken [after pouring the invetment into a ring] to dry. Moreover, the existence of a "water float" is observed at this time, and "the amount of craters" is measured in depth meter.
(5) Heating incineration is carried out at 700 degrees C, and dental gold-silver-palladium alloys are cast, and cool to a room temperature, take out from mold, return to a pattern, and evaluate the good of compatibility, and a defect, after carrying out coagulation hardening by the same approach as the above using the full crown mold and MOD inlay mold in A.D.A specification No.2 and drying enough about compatibility.
(6) Measure time amount until 0.5 cc water is dropped at the sheet sample placed horizontally, and it absorbs water and permeates a rear face about the hydrophobicity of a sheet. In addition, what has the hydrophobic film is dropped at a hydrophobic film side.
[0025]
[Table 1]

		サンプル	フィルム	シートの吸水性（吸水時間）	埋没材凝結硬化特性				鋳造性
					鋳造法	乾燥時間（分）	へこみ量（mm）	水浮き発生の有無	適合性
実施例	1	A	10μm厚 ポリエチレン	30分以上	乾式	12	0	無し	良好
					湿式	12	0	無し	良好
	2	B	15μm厚 エチレン酢ビ	30分以上	乾式	11	1.0	無し	良好
					湿式	12	0	無し	良好
	3	C	20μm厚 ビニロン（疎水性）	30分以上	乾式	12	0	無し	良好
					湿式	12	0	無し	良好
比較例	1	D	無し	20分	乾式	12	1.5	無し	良好
					湿式	12	1.0	無し	良好
	2	E	無し	0（瞬時浸透）	乾式	4	6	無し	鋳型破損
					湿式	23	0	有り	良好
	3	F	無し	7分	乾式	6	7	無し	鋳型破損
					湿式	8	4	無し	良好

[0026] In the case of this invention example, wet either dry type casting or casting has checked that the compatibility of a casting object was also satisfactory satisfactory to the "water float" and the "crater" at the time of desiccation of the invetment, and coagulation hardening the passage clear from the above-mentioned table 1. What does not have the

hydrophobic film to it produced the about 1.0-1.5mm "crater", although the water-repellent sample D did not have a "water float" and compatibility was also good. Moreover, in dry type casting, the "crater" produced mold breakage greatly, the "water float" was generated in wet casting, the drying time became long, and the strong sample E of absorptivity had bad workability. Moreover, in dry type casting, as for the weak sample F of absorptivity, the "crater" produced mold destruction greatly.

[0027]

[Effect of the Invention] The ring liner for dental casting by this invention has sufficient thermal resistance of a ceramic sheet, cushioning properties, the positive water repellence of the hydrophobic film, and smooth nature, excluding asbesto at all. A mixing water ratio is not changed, the rate of the setting expansion of the invetment can be controlled correctly, without a liner absorbing water, since a feel at the time of equipping a ring with the hydrophobic film can intercept the water in invetment mud certainly well, and a water float and a crater are not generated, either. Moreover, expansion of an invetment particle is not controlled by the cushioning properties which were excellent in the ceramic sheet used as a base material at the time of the setting expansion of the invetment, and the smooth nature of the hydrophobic film, but further, also at the time of heating expansion, heating expansion of the invetment is not controlled but the compatibility to the deficit bridge abutment section of a casting restoration object also becomes good. Thus, it has the effectiveness that the engine performance required of the liner for dental casting improves from the conventional thing.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] This invention relates to the ring liner for dental casting which carries out the lining inside a casting ring and which is used for it in dental casting.

[Translation done.]

PRIOR ART

[Description of the Prior Art] It is used for it as a cushioning material for compensating the contraction produced in case the molten metal cast by the ring for dental casting is cooled by even the room temperature, carrying out the lining of the ring liner for dental casting inside the ring for dental casting. Conventionally, the asbestos ribbon which cut out the asbestos paper which uses asbestos as a principal component as this kind of a ring liner in the shape of a strip of paper is used, and the ceramic paper which recently uses ceramic fiber, such as a silica alumina fiber, as a principal component in part came to be used.

[0003] Although an alloy is cast and an inlay, crown, the metal base, the bar for casting, the clasp for casting, etc. are produced when restoring the gear tooth (cavity) which fell ill by the caries with dentistry, and the gear tooth which fell out, the precision casting called a lost wax process on the occasion of casting is used. When this is inaccurate, it is because a patient's gear tooth cannot be certainly equipped with an inlay, crown, etc. which were cast.

[0004] However, since it will contract about 1.5 to 2.3% by the time it is cooled by ordinary temperature after solidifying a dental alloy in mold (invetment) also with a lost wax process, the invetment needs to carry out only expansion which compensates contraction of a casting alloy during coagulation hardening and heating. The mold at the time of casting the molten metal of an alloy needs to be larger about 1.5 to 2.3% than the dimension of a wax pattern, and, for this reason, th invetment carries out the setting expansion and thermal expansion. The invetment makes the pattern formed with the wa into the casting ring buried, carries out heating dewaxing of the invetment within an electric furnace after coagulation hardening, and forms mold.

[0005] Therefore, the ring liner which absorbs expansion of the invetment to the inner skin of a casting ring is prepared. The lining of this ring liner is carried out to the inner skin of a casting ring in the shape of a strip of paper. Therefore, to have the cushioning properties which control and absorb fitting a casting ring, and the setting expansion at the time of th coagulation of the invetment and the thermal expansion at the time of heating, and for the heated ring liner to maintain th shape of a sheet, and not to collapse in the shape of cotton are demanded. As a material which fills such a demand, the asbestos ribbon has been used conventionally.

[0006] In an actual dental casting activity, the absorptivity of a ring liner turns into an important property. That is, in the activity in which a wax pattern is made buried by the invetment, it mixes by the weight ratio which had invetment powd and water decided just before an activity, and the invetment of the shape of mud acquired by doing in this way is poured out in the ring which carried out the interior of the liner. Then, it is left in ordinary temperature and coagulation hardenir of the invetment is carried out. At this time, the approach which is not made to include the approach of including water i a liner just before pouring out the invetment for a "wet method" and water, but is poured out as it is is called "dry process." By the way, if a mixing water ratio changes when the moisture in the invetment absorbs water to a liner, after filling a ring with the invetment before carrying out coagulation hardening, it will have effect which were enumerated below on a casting property or casting nature.

(1) The mixing water ratio of the invetment changes with water absorption of a liner, and the expansion coefficient at th time of coagulation hardening changes.

(2) The mixing water ratio of the invetment changes with water absorption of a liner partially, and produce a crack at the time of coagulation hardening.

(3) If the water absorption rate of a liner is quick, casting nature besides the fault stated by (1) and (2) will also worsen. That is, in a wet method, if water superfluous when the water absorption rate of a liner is quick, and water is included beforehand is absorbed and the invetment expands, a liner will be compressed and the so-called "water float" by which t film of water is made on discharge and an invetment up front face will generate the included water. The time amount of coagulation hardening becomes long by this, and working hours become long. Moreover, in dry process, the water in the invetment is absorbed superfluously, an impression is generated in the center of the invetment, and the so-called "crater" occurs. This "crater" is cratered in the shape of a half moon in many cases.

(4) Although a "crater" occurs too since moisture is gradually absorbed while the invetment carries out coagulation hardening also when a water absorption rate is slow although a liner absorbs water, this "crater" becomes deep to a wed

shape, the invetment layer of the wax pattern upper part becomes thin, and it becomes the cause of breakage.
[0007] Although there is absorptivity also in the asbestos ribbon currently conventionally used as a liner, consistencies ar 0.8 g/cm3. Extent and since it is comparatively high, the absorptivity is not strong. About 15 - 40 seconds are taken to permeate as a numeric value showing absorptivity, if 0.5 cc water is dropped at an asbestos ribbon. Since an asbestos ribbon has such absorptivity, before pouring in the invetment so that the moisture of the invetment may not be absorbed too much in a dental casting activity, moisture is included beforehand. Moreover, if moisture is included too much, since "water float" will be generated, it is adjusting so that it may become moderate water content. An actual activity is underwater immersed for 1 - 2 seconds in an asbestos ribbon. Thus, if invetment mud is poured out after carrying out water beforehand, there will be "few craters" and they will serve as a good coagulation hardening activity without a "water float." Conventionally, such an approach is taken widely and it was working with the "wet method." However, a wet method is the working method devised as not changing the mixing water ratio of the invetment as much as possible when using asbestos for a liner, and is the technique accompanied by dispersion in a mixing water ratio fundamentally. That is, since an asbestos ribbon has absorptivity, if the invetment is poured in, moisture will be taken by asbestos and the mixing water ratio of the invetment will change. Then, he is trying not to change a mixing water ratio by including moisture in asbestos beforehand. However, there are many places for which there is dispersion also in the absorptivity of an asbestos ribbon and it depends on experience of a dental technician or a can.
[0008] On the other hand, by abolishing the absorptivity of a ring liner and considering as water repellence, receipts and payments of water are eliminated, the mixing water ratio of the invetment is not changed, there is also an idea of saying that exact casting will be performed, contrary to a wet method, and such an approach is "dry process." In this case, vaseline was applied to the asbestos ribbon, or water proofing was performed to it by the silicone spray etc., and it has been coped with. However, the activity of such water-repellent grant is complicated, and when using an asbestos ribbon, has almost been performed with the wet method.
[0009] Thus, although the asbestos ribbon has been used in dental casting more widely than before, in U.S. inside, the use to a building material is forbidden by the thing that asbestos has carcinogenic, and regulating also in Japan etc. has become a social problem in recent years. Requests into the ingredient which replaces asbestos also in dentistry have been mounting. Thus, the ceramic fiber system ring liner which does not use asbestos and which used alumina silica system fiber as the principal component has also come to be marketed.
[0010]

PRIOR ART

[Description of the Prior Art] It is used for it as a cushioning material for compensating the contraction produced in case the molten metal cast by the ring for dental casting is cooled by even the room temperature, carrying out the lining of the ring liner for dental casting inside the ring for dental casting. Conventionally, the asbestos ribbon which cut out the asbestos paper which uses asbestos as a principal component as this kind of a ring liner in the shape of a strip of paper is used, and the ceramic paper which recently uses ceramic fiber, such as a silica alumina fiber, as a principal component in part came to be used.

[0003] Although an alloy is cast and an inlay, crown, the metal base, the bar for casting, the clasp for casting, etc. are produced when restoring the gear tooth (cavity) which fell ill by the caries with dentistry, and the gear tooth which fell out, the precision casting called a lost wax process on the occasion of casting is used. When this is inaccurate, it is because a patient's gear tooth cannot be certainly equipped with an inlay, crown, etc. which were cast.

[0004] However, since it will contract about 1.5 to 2.3% by the time it is cooled by ordinary temperature after solidifying a dental alloy in mold (invetment) also with a lost wax process, the invetment needs to carry out only expansion which compensates contraction of a casting alloy during coagulation hardening and heating. The mold at the time of casting the molten metal of an alloy needs to be larger about 1.5 to 2.3% than the dimension of a wax pattern, and, for this reason, th invetment carries out the setting expansion and thermal expansion. The invetment makes the pattern formed with the wa into the casting ring buried, carries out heating dewaxing of the invetment within an electric furnace after coagulation hardening, and forms mold.

[0005] Therefore, the ring liner which absorbs expansion of the invetment to the inner skin of a casting ring is prepared. The lining of this ring liner is carried out to the inner skin of a casting ring in the shape of a strip of paper. Therefore, to have the cushioning properties which control and absorb fitting a casting ring, and the setting expansion at the time of th coagulation of the invetment and the thermal expansion at the time of heating, and for the heated ring liner to maintain th shape of a sheet, and not to collapse in the shape of cotton are demanded. As a material which fills such a demand, the asbestos ribbon has been used conventionally.

[0006] In an actual dental casting activity, the absorptivity of a ring liner turns into an important property. That is, in the activity in which a wax pattern is made buried by the invetment, it mixes by the weight ratio which had invetment powd and water decided just before an activity, and the invetment of the shape of mud acquired by doing in this way is poured out in the ring which carried out the interior of the liner. Then, it is left in ordinary temperature and coagulation hardenir of the invetment is carried out. At this time, the approach which is not made to include the approach of including water i a liner just before pouring out the invetment for a "wet method" and water, but is poured out as it is is called "dry process." By the way, if a mixing water ratio changes when the moisture in the invetment absorbs water to a liner, after filling a ring with the invetment before carrying out coagulation hardening, it will have effect which were enumerated below on a casting property or casting nature.

(1) The mixing water ratio of the invetment changes with water absorption of a liner, and the expansion coefficient at th time of coagulation hardening changes.

(2) The mixing water ratio of the invetment changes with water absorption of a liner partially, and produce a crack at the time of coagulation hardening.

(3) If the water absorption rate of a liner is quick, casting nature besides the fault stated by (1) and (2) will also worsen. That is, in a wet method, if water superfluous when the water absorption rate of a liner is quick, and water is included beforehand is absorbed and the invetment expands, a liner will be compressed and the so-called "water float" by which t film of water is made on discharge and an invetment up front face will generate the included water. The time amount of coagulation hardening becomes long by this, and working hours become long. Moreover, in dry process, the water in th invetment is absorbed superfluously, an impression is generated in the center of the invetment, and the so-called "crater' occurs. This "crater" is cratered in the shape of a half moon in many cases.

(4) Although a "crater" occurs too since moisture is gradually absorbed while the invetment carries out coagulation hardening also when a water absorption rate is slow although a liner absorbs water, this "crater" becomes deep to a wed

shape, the invetment layer of the wax pattern upper part becomes thin, and it becomes the cause of breakage.
[0007] Although there is absorptivity also in the asbestos ribbon currently conventionally used as a liner, consistencies ar 0.8 g/cm3. Extent and since it is comparatively high, the absorptivity is not strong. About 15 - 40 seconds are taken to permeate as a numeric value showing absorptivity, if 0.5 cc water is dropped at an asbestos ribbon. Since an asbestos ribbon has such absorptivity, before pouring in the invetment so that the moisture of the invetment may not be absorbed too much in a dental casting activity, moisture is included beforehand. Moreover, if moisture is included too much, since "water float" will be generated, it is adjusting so that it may become moderate water content. An actual activity is underwater immersed for 1 - 2 seconds in an asbestos ribbon. Thus, if invetment mud is poured out after carrying out water beforehand, there will be "few craters" and they will serve as a good coagulation hardening activity without a "water float." Conventionally, such an approach is taken widely and it was working with the "wet method." However, a wet method is the working method devised as not changing the mixing water ratio of the invetment as much as possible when using asbestos for a liner, and is the technique accompanied by dispersion in a mixing water ratio fundamentally. That is, since an asbestos ribbon has absorptivity, if the invetment is poured in, moisture will be taken by asbestos and th mixing water ratio of the invetment will change. Then, he is trying not to change a mixing water ratio by including moisture in asbestos beforehand. However, there are many places for which there is dispersion also in the absorptivity of an asbestos ribbon and it depends on experience of a dental technician or a can.
[0008] On the other hand, by abolishing the absorptivity of a ring liner and considering as water repellence, receipts and payments of water are eliminated, the mixing water ratio of the invetment is not changed, there is also an idea of saying that exact casting will be performed, contrary to a wet method, and such an approach is "dry process." In this case, vaseline was applied to the asbestos ribbon, or water proofing was performed to it by the silicone spray etc., and it has been coped with. However, the activity of such water-repellent grant is complicated, and when using an asbestos ribbon, has almost been performed with the wet method.
[0009] Thus, although the asbestos ribbon has been used in dental casting more widely than before, in U.S. inside, the us to a building material is forbidden by the thing that asbestos has carcinogenic, and regulating also in Japan etc. has become a social problem in recent years. Requests into the ingredient which replaces asbestos also in dentistry have been mounting. Thus, the ceramic fiber system ring liner which does not use asbestos and which used alumina silica system fiber as the principal component has also come to be marketed.
[0010] These ceramic fiber system liners use ceramic fiber and rock wool as a principal component, and are using synthetic resin or natural pulp, such as acrylic resin, as the binder. Generally the consistencies of a ceramic sheet are 0.4 g/cm3. As compared with an asbestos ribbon, cushioning properties are good below, and neither the setting expansion at the time of the coagulation of the invetment nor the thermal expansion at the time of heating is controlled also by thickness thinner than the conventional asbestos ribbon. moreover, there is an advantage, like thermal resistance also comes out enough and there is.
[0011] If the inorganic fiber itself, such as ceramic fiber, rock wool, and a glass fiber, will be a hydrophilic property, the binder to be used will become with the liner of a hydrophilic property (absorptivity) in the case of hydrophilic ingredient such as natural pulp, if its attention is paid to the field of absorptivity, and water-repellent ingredients, such as synthetic resin, are used, according to the amount, the degree of water repellence [liner] will become strong. Generally the consistencies of a ceramic sheet are 0.4 g/cm3, as mentioned already. It is 1/2 or less [of the following and an asbestos ribbon], and if the absorptivity when not using a water-repellent ingredient is very large and waterdrop is dropped, it wi permeate in an instant. Moreover, when immersed in water, it absorbs water more than the 300 weight sections to the amount of Motoshige in an instant mostly. Therefore, when the large sheet of such absorptivity is made into a ring liner, invetment mud is poured out in a wet method, a "water float" will be generated and a "crater" will be produced in dry process. When using synthetic resin for an organic binder, water repellence becomes strong, so that there are many synthetic-resin additions. In order to obtain required labor strength and to usually add more than 5 weight sections, the ring liner of synthetic-resin use has low absorptivity. When extent of absorptivity does not absorb water mostly, it is usable at both wet and dry type, but when absorbing water slightly, especially in dry process, it becomes easy to generat a "crater." Then, in order to give the water repellence stabilized so that water might hardly be absorbed, there are some which are carrying out water repellent processing of a silicone system or a fluorine system. Since the ceramic system lin which has these water repellence is excellent in thermal resistance and cushioning properties and has water repellence, i is the outstanding ring liner to which the mixing water ratio of the invetment is not changed.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] The ring liner for dental casting by this invention has sufficient thermal resistance of a ceramic sheet, cushioning properties, the positive water repellence of the hydrophobic film, and smooth nature, excluding asbestos at all. A mixing water ratio is not changed, the rate of the setting expansion of the invetment can be controlled correctly, without a liner absorbing water, since a feel at the time of equipping a ring with the hydrophobic film can intercept the water in invetment mud certainly well, and a water float and a crater are not generated, either. Moreover, expansion of an invetment particle is not controlled by the cushioning properties which were excellent in the ceramic sheet used as a base material at the time of the setting expansion of the invetment, and the smooth nature of the hydrophobic film, but further, also at the time of heating expansion, heating expansion of the invetment is not controlled but the compatibility to the deficit bridge abutment section of a casting restoration object also becomes good. Thus, it has the effectiveness that the engine performance required of the liner for dental casting improves from the conventional thing.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] The ring liner for dental casting by this invention has sufficient thermal resistance of a ceramic sheet, cushioning properties, the positive water repellence of the hydrophobic film, and smooth nature, excluding asbesto at all. A mixing water ratio is not changed, the rate of the setting expansion of the invetment can be controlled correctly, without a liner absorbing water, since a feel at the time of equipping a ring with the hydrophobic film can intercept the water in invetment mud certainly well, and a water float and a crater are not generated, either. Moreover, expansion of an invetment particle is not controlled by the cushioning properties which were excellent in the ceramic sheet used as a base material at the time of the setting expansion of the invetment, and the smooth nature of the hydrophobic film, but further, also at the time of heating expansion, heating expansion of the invetment is not controlled but the compatibility to the deficit bridge abutment section of a casting restoration object also becomes good. Thus, it has the effectiveness that the engine performance required of the liner for dental casting improves from the conventional thing.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Although there is not only no asbestine harmful nature, but the engine performance as a ring liner has been progressing compared with the conventional asbestos ribbon, the ceramic system liner in recent years also has the following technical problems, as described above.
(1) Although water repellence is given by the conventional water-repellent ceramic system liner, it is not completeness, and although it is small, in order to absorb water, produce about 1-2mm a "crater" in casting. It is better not to produce a "crater" ideally, although faults, such as a casting defect, hardly occur in the amount of craters of this amount.
(2) With a ceramic sheet with a porous front face, the setting expansion at the time of the coagulation of the invetment, especially the invetment with a precise particle size may be controlled. Although a mixing water ratio does not change since there is no migration of moisture when water repellence is given to a ceramic sheet, ceramic fiber or the diameter o fiber of rock wool is about 3-6 micrometers, and the opening between fiber is still larger and turns into an opening 50 micrometers or more in a large part. Moreover, even when inorganic fine particles, such as alumina powder, are mixed, a about 30-micrometer opening is produced everywhere. On the other hand, a particle with the thing of the gypsum-fibrosum system by which the grain size of the invetment is generally marketed finer than 50 micrometers occupies 90% or more. The particle smaller than the opening on the front face of a sheet in it serves as a ceramic sheet and a form whic eats away between the ceramic fiber of the sheet surface section in the interface of the invetment. Although the invetmen carries out the setting expansion, if there is no adhesion firmly and it is caught when a particle eats into a liner, expansio will be controlled and a predetermined expansion coefficient will be obtained. As mentioned above, in order to carry out precision casting, the expansion coefficient of the invetment is designed so that contraction of an alloy may be suited. Therefore, the invetment should be expanded as a design. Also when expansion is controlled by adhesion of this liner an the invetment, poor adaptation hardly results, but in order that the invetment of these days may acquire a casting side [****], it is thought that it is tended further carry out eburnation of the grain size of the invetment, it increases conventionally, and adhesion of this liner and the invetment and the problem of connection become large. The ring liner to which the contact surface with the invetment is smooth, loses adhesion of an invetment particle and connection, and thus, it not only gives water repellence to a liner, but it does not control expansion is called for.
(3) It is that a feel is [the ceramic system liner of the former / fault / 3rd] bad. An early ceramic sheet has some to whic a shot is removed and a feel is becoming good comparatively in recent years, although many shots felt rough. However, good feel like the usual paper of fine quality is not obtained. Although it pushed against the ring with the finger so that t inner skin and the liner of a ring might fit when using a liner, at that time, a feel is bad and the conventional ceramic she had bad operability.

[Translation done.]

MEANS

[Means for Solving the Problem] the thermal resistance which was excellent in the ceramic sheet when the ring liner for dental casting of this invention prepared the hydrophobic film at least in one side of the sheet which uses ceramic fiber as a principal component, cushioning properties, and the positive water repellence by the hydrophobic film and surface smooth nature -- combining -- ** -- it is a thing.

[0014] About the ceramic sheet used as a base material, by dental casting, in case heating dewaxing of the wax pattern is carried out, in order to heat at 700-800 degrees C with an electric furnace, ceramic fiber with a heat-resistant temperature of 1000 degrees C or more is used as the heat-resistant aggregate. As an inorganic fiber which has the thermal resistance of 1000 degrees C or more, they are aluminum 2O3 / SiO2. A weight ratio can use an alumina fiber besides the ceramic fiber of 0.4-0.6, a zirconia fiber, milt fiber, and a potassium titanate fiber. Or rock wool with a heat-resistant temperature of 700-800 degrees C may be blended with this. Furthermore, the inorganic fine particles which make a glass fiber and alumina powder representation for the reinforcement on the strength after disappearance of an organic binder may be blended at the time of heating. The loadings of the ceramic fiber used as the aggregate are required for more than 30 weight sections.

[0015] Although hydrophobic synthetic-resin emulsions, such as a natural binder of hydrophilic properties, such as detailed cellulose fiber, CMC, and gelatin, and acrylic resin, and vinyl acetate resin, can be used as an organic binder for obtaining labor strength, especially if it is the binder with which required labor strength is obtained, it will not be limited to these. a binder (the minimum coat formation temperature) soft in order to consider as a flexible liner especially, for example, MFT, -- an acrylic emulsion 0 degree C or less and a plasticizer -- the vinyl acetate emulsion whose mixing rati is about 50% is suitable, and 5 - 20 weight section is suitable for the loadings. In addition, it may use together with synthetic resin as an organic material, the natural pulp currently used from the former may be blended, and flexible aesthetic property may be taken out.

[0016] As hydrophobic film prepared at least in one side of the sheet fabricated by the above ingredient combination, hydrophobic synthetic-resin films, such as polyethylene, polypropylene, polystyrene, a polyvinyl chloride, a polyvinylidene chloride, polyvinyl alcohol (hydrophobicity), a fluororesin, a polycarbonate, acetate, polyester, and a polyamide, may be stuck by adhesives or thermal melting arrival, and the paste of natural rubber latex, synthetic rubber latex, a synthetic-resin latex, etc. may be applied. If it says from a manufacture side, it is efficient to align the melting sheet of a thermoplastics film with a ceramic sheet, to film-ize resin and to stick it with a cold press. Moreover, if it says from a presentation, since it will be burned down by organic [the amount of] at a heating dewaxing process by dental casting, what does not generate harmful gas, such as chlorine gas, or does not generate a nasty smell, a lot of smoke, etc. is desirable in that case. The thinner one of the thickness of the hydrophobic film is good in the range which can secure water repellence and smooth nature. That is, since it is important as requirements other than water repellence and smooth nature not to check the flexibility of the whole liner, to harness the cushioning properties of the ceramic sheet used as a base material in the maximum, and to lessen a burned down part at the time of incineration as much as possible, the thinner one is good, but about 5-30 micrometers is desirable so that neither a pinhole nor a gash may occur at the time of lamination processing. Moreover, said canal **** may be carried out as [prepare / not only in one side of a sheet but in both sides], and may be constituted in ring inner skin and the made reversible type ring liner also in respect of which. Furthermore, if said canal **** is processed into saccate and it enables it to also cover the end face of a sheet again, since it can prevent completely that the moisture of the invetment infiltrates into a sheet and the absorptivity of the sheet itself and water repellence will not pose a problem in it, degrees of freedom of selection, such as a presentation of an organic binder and coating weight, can be extended.

OPERATION

[Function] If the ring liner which produced the sheet on the above conditions and prepared the hydrophobic film at least ir the one side, i.e., the field in contact with the invetment, is used, since a film is in the field of the side forced with a finger in order to make ring inner skin fit, a feel is good, and operability is good. Next, change of a mixing water ratio does not arise but the invetment can perform exact dental casting which does not bar the setting expansion and thermal expansion. That is, a mixing water ratio is not changed, without a liner absorbing water, in order to intercept the water in invetment mud certainly and completely with the thin hydrophobic film prepared in the field in contact with the invetment. Therefore, the rate of the setting expansion of the invetment is correctly controllable. Moreover, since there is no migration of moisture between a ring liner and the invetment and a water float and a crater do not occur, an efficient activity can be done, and there is also no risk of invetment layer breakage of the wax pattern upper part. Expansion as a design can be carried out without controlling expansion of an invetment particle by the cushioning properties which excelled [setting expansion / of the invetment] in the ceramic sheet used as a base material, and the smooth nature of the hydrophobic film. Moreover, also in case heating incineration of the wax pattern is carried out with an electric furnace, heating expansion of the invetment is not controlled. As mentioned above, if the ring liner by this invention is used, denta casting with it can be performed. [good and workability and] [exact]

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（A）　(11)特許出願公開番号

特開平6－327704

(43)公開日　平成６年(1994)11月29日

(51)Int.Cl.[5]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ａ６１Ｃ　13/20		Ｂ　7108－4C		
Ｂ２２Ｃ　9/04		Ｊ　9266－4E		
Ｂ２８Ｂ　1/52		9152－4G		

審査請求　未請求　請求項の数２　ＦＤ　（全　６　頁）

(21)出願番号　特願平5－139524

(22)出願日　平成５年(1993)５月18日

(71)出願人　593110410
前田　信一
大阪府柏原市法善寺１－13－１

(71)出願人　000232760
日本無機株式会社
東京都千代田区神田錦町３丁目１番地

(72)発明者　前田　孝
大阪府八尾市志紀町南３－32－１

(72)発明者　宮下　聖
岐阜県不破郡垂井町630番地　日本無機株式会社垂井工場内

(74)代理人　弁理士　清水　善▲廣▼

(54)【発明の名称】　歯科鋳造用リングライニング材

(57)【要約】
【構成】　セラミック繊維を主成分とするシートの少なくとも片面に疎水性膜を設けたことを特徴とする歯科鋳造用リングライニング材。
【効果】　本発明による歯科鋳造用リングライニング材はアスベストを全く含まず、セラミックシートの十分な耐熱性、クッション性と、疎水性膜の確実な撥水性、および平滑性を合わせ持つものである。

1

【特許請求の範囲】

【請求項１】　セラミック繊維を主成分とするシートの少なくとも片面に疎水性膜を設けたことを特徴とする歯科鋳造用リングライニング材。

【請求項２】　前記疎水性膜は前記シートに貼り合わせた合成樹脂フイルムであることを特徴とする請求項１記載の歯科鋳造用リングライニング材。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、歯科鋳造において鋳造用リングの内側に裏装して用いる歯科鋳造用リングライニング材に関するものである。

【０００２】

【従来の技術】歯科鋳造用リングライニング材は、歯科鋳造用リングに鋳込まれた溶湯が室温にまで冷却される際に生じる収縮を補償するためのクッション材として、歯科鋳造用リングの内側に裏装して使用されている。従来、この種のリングライニング材としてはアスベストを主成分とするアスベスト紙を短冊状に裁断したアスベストリボンが用いられ、最近になって一部シリカ・アルミナ繊維等のセラミック繊維を主成分とするセラミック紙が用いられるようになった。

【０００３】歯科でう蝕で罹患した歯（虫歯）や脱落した歯を修復する場合、合金を鋳造して、インレー、クラウン、金属床、鋳造用バー、鋳造用クラスプ等を作製するが、鋳造に際してはロストワックス法と呼ばれる精密鋳造法が用いられる。これは精度が悪いと、鋳造したインレーやクラウン等を患者の歯に確実に装着することができないためである。

【０００４】しかしながらロストワックス法でも歯科用合金は鋳型（埋没材）の中で凝固した後に常温に冷却されるまでの間に１．５～２．３%程度収縮するので、埋没材は凝結硬化中及び加熱中に鋳造合金の収縮を補償するだけの膨張をすることが必要である。合金の溶湯を鋳込む際の鋳型はワックスパターンの寸法よりも１．５～２．３%程度大きめになっていることが必要で、このため埋没材は硬化膨張と熱膨張をするようになっている。埋没材は鋳造リング中にワックスで形成したパターンを埋没させ、埋没材を凝結硬化後に電気炉内で加熱脱ろうして鋳型を形成する。

【０００５】従って鋳造リングの内周面に埋没材の膨張を吸収するリングライニング材を設けている。このリングライニング材は、鋳造用リングの内周面に短冊状にて裏装している。そのため鋳造用リングにフィットすること、埋没材の凝結時の硬化膨張や加熱時の熱膨張を抑制せず、且つ吸収するクッション性を有すること、加熱されたリングライニング材はシート状を維持し綿状に崩れないことが要求される。このような要求を満たす素材として、従来よりアスベストリボンが使用されてきた。

【０００６】実際の歯科鋳造作業に於いては、リングライニング材の吸水性が重要な特性になってくる。すなわち埋没材でワックスパターンを埋没させる作業では、作業直前に埋没材粉と水を決められた重量比率で混合し、このようにして得られた泥状の埋没材をライニング材を内装したリング内に注ぐ。この後、常温で放置し埋没材を凝結硬化させる。この時、埋没材を注ぐ直前にライニング材に水を含ませる方法を「湿式法」、水を含ませずそのまま注ぐ方法を「乾式法」と称している。ところで、埋没材をリングに注いでから凝結硬化するまでの間に埋没材中の水分がライニング材に吸水されることにより混水比が変化すると鋳造特性や鋳造作業性に、下記に列挙したような影響を及ぼす。

（１）ライニング材の吸水により埋没材の混水比が変化し凝結硬化時の膨張率が変わる。

（２）ライニング材の吸水により部分的に埋没材の混水比が変化し凝結硬化時に亀裂を生じる。

（３）ライニング材の吸水速度が速いと、（１）、（２）で述べた不具合の他、鋳造作業性も悪くなる。すなわち湿式法ではライニング材の吸水速度が速いと、予め水を含ませる時点で過剰の水を吸収し、埋没材が膨張をするとライニング材は圧縮され、含んだ水を吐き出し、埋没材上部表面に水の膜ができる、いわゆる「水浮き」が発生する。これにより凝結硬化の時間が長くなり作業時間が長くなる。また、乾式法では埋没材中の水を過剰に吸収し埋没材中央にくぼみが生じ、いわゆる「へこみ」が発生する。この「へこみ」は半月状にへこむことが多い。

（４）ライニング材が吸水するものの吸水速度が遅い場合にも、埋没材が凝結硬化する間に徐々に水分を吸収するので、やはり「へこみ」が発生するが、この「へこみ」は楔状に深くなり、ワックスパターン上部の埋没材層が薄くなり破損の原因となる。

【０００７】従来よりライニング材として使用されているアスベストリボンにも吸水性があるが、密度が０．８ｇ／ｃｍ³ 程度と比較的高いため、その吸水性は強いものではない。吸水性を表す数値として、例えばアスベストリボンに０．５ｃｃの水を滴下すると浸透するまでに約１５～４０秒を要する。アスベストリボンはこのような吸水性をもつため、歯科鋳造作業に当たっては埋没材の水分を吸収しすぎないよう、埋没材を注ぎ込む前に予め水分を含ませている。また、水分を含ませ過ぎると、「水浮き」が発生するので適度の含水率となるように調整している。実際の作業はアスベストリボンを水中に１～２秒間浸漬する。このように予め含水させた後に埋没材泥を注げば、「へこみ」も少なく、「水浮き」のない良好な凝結硬化作業となる。従来は広くこのような方法が採られており、「湿式法」で作業されていた。しかしながら湿式法はライニング材にアスベストを使用する上で埋没材の混水比をできるだけ変化をさせないように考案された作業法であり、根本的に混水比のばらつきを伴

う手法である。すなわちアスベストリボンは吸水性を有するため、埋没材を注ぎ込むとアスベストに水分を奪われ埋没材の混水比が変化する。そこで予めアスベストに水分を含ませることにより混水比を変化させないようにしている。しかしアスベストリボンの吸水性にもばらつきがあり、歯科技工士の経験やカンに頼るところが多い。

【０００８】一方、湿式法とは逆に、リングライニング材の吸水性をなくし、撥水性とすることにより、水の出入りを排除して埋没材の混水比を変化させず正確な鋳造を行おうという考えもあり、このような方法が「乾式法」である。この場合にはアスベストリボンにワセリンを塗布したり、シリコーンスプレー等で防水処理を施したりして対処してきた。しかしながら、このような撥水性付与の作業は煩雑でありアスベストリボンを使用する場合は、ほとんど湿式法で行われてきた。

【０００９】このように歯科鋳造では従来より広くアスベストリボンが使用されてきたが、近年アスベストは発癌性があるとのことでアメリカ国内に於いては建築材料への使用を禁止しており、日本に於いても規制する等、社会問題となっている。歯科においてもアスベストに代わる材料への要望が高まってきている。このような中で、アスベストを使用しない、アルミナ・シリカ系繊維を主成分としたセラミック繊維系リングライニング材も市販されるようになってきた。

【００１０】これらのセラミック繊維系ライニング材はセラミック繊維やロックウールを主成分とし、アクリル樹脂等の合成樹脂または天然パルプをバインダーとしている。セラミックシートの密度は一般的に０．４ｇ／ｃｍ^3 以下でアスベストリボンと比較しクッション性が良く、従来のアスベストリボンより薄い厚さでも埋没材の凝結時の硬化膨張や加熱時の熱膨張を抑制しない。また耐熱性も十分である等の利点がある。

【００１１】吸水性の面に着目すると、セラミック繊維、ロックウール、ガラス繊維等の無機繊維自体は親水性であり、使用するバインダーが天然パルプ等の親水性材料の場合には親水性（吸水性）のライニング材となり、合成樹脂等の撥水性材料を使用すると、その量に応じライニング材も撥水性の度合いが強くなる。セラミックシートの密度は既述したように一般的に０．４ｇ／ｃｍ^3 以下とアスベストリボンの１／２以下であり、撥水性材料を使用しない場合の吸水性は極めて大きく、水滴を滴下すると瞬時に浸透する。また水に浸漬した場合には、ほぼ瞬時に元重量に対し３００重量部以上吸水する。従って、このような吸水性の大きいシートをリングライニング材とした場合は、湿式法では埋没材泥を注ぐと「水浮き」が発生し、乾式法では「へこみ」を生ずる。有機バインダーに合成樹脂を使用する場合は、合成樹脂添加量が多いほど撥水性が強くなる。必要な作業強度を得るために、通常５重量部以上添加するため、合成樹脂使用のリングライニング材は吸水性が低い。吸水性の程度がほぼ吸水しない場合は湿式、乾式両方で使用可能であるが、僅かに吸水する場合は、特に乾式法に於いて「へこみ」が発生し易くなる。そこでほとんど水を吸収しないよう安定した撥水性を付与するためにシリコーン系或いはフッ素系の撥水剤処理をしているものもある。これらの撥水性を有するセラミック系ライニング材は耐熱性、クッション性に優れ、且つ撥水性を有するので埋没材の混水比を変化させない優れたリングライニング材となっている。

【００１２】

【発明が解決しようとする課題】前記したとおり、近年のセラミック系ライニング材は従来のアスベストリボンに比べアスベストの有害性がないばかりでなく、リングライニング材としての性能が進歩してきているが、下記のような課題も有している。

（１）従来の撥水性セラミック系ライニング材には撥水性を付与されているものの完全ではなく、僅かだが吸水するため鋳造作業において１～２ｍｍ程度の「へこみ」を生ずる。この程度のへこみ量では鋳造欠陥等の不具合が発生することはほぼないが理想的には「へこみ」は生じない方がよい。

（２）表面がボーラスなセラミックシートでは埋没材、特に粒径の緻密な埋没材の凝結時の硬化膨張を抑制する場合がある。セラミックシートに撥水性を付与した場合には水分の移動がないため混水比は変化しないが、セラミック繊維、或いはロックウールの繊維径は３～６μｍ程度であり、繊維間の空隙は更に広く、大きい部分では５０μｍ以上の空隙となる。またアルミナ粉等の無機粉体を混抄した場合でも３０μｍ程度の空隙はいたるところに生じる。一方、埋没材の粒度は、一般に市販されている石膏系のものは５０μｍより細かい粒子が９０％以上を占める。その中でシート表面の空隙より小さな粒子は、セラミックシートと埋没材の界面に於いてシート表層部のセラミック繊維間に食い込む形となる。埋没材は硬化膨張をするが粒子がライニング材に食い込むことにより強固に付着ないし引っかかると膨張を抑制され所定の膨張率が得られないことになる。前述したように精密鋳造をするため埋没材の膨張率は合金の収縮率と合うように設計されている。従って埋没材は設計どおり膨張させるべきである。このライニング材と埋没材の付着により膨張が抑制された場合も適合不良まで至ることはほぼないが、昨今の埋没材はより滑沢な鋳造面を得るため埋没材の粒度は更に緻密化される傾向にあり、従来より増してこのライニング材と埋没材の付着、引っかかりの問題は大きくなるものと思われる。このような中でライニング材に撥水性を付与するだけでなく、埋没材との接触面が平滑で埋没材粒子の付着、引っかかりをなくし膨張を抑制しないリングライニング材が求められている。

（３）第３の欠点は従来のセラミック系ライニング材は

手触りが悪いことである。初期のセラミックシートはショットが多くざらついていたが近年ではショットが除去され比較的手触りが良くなってきているものもある。しかし通常の上質紙のような良好な手触りは得られない。ライニング材を使用するときは、リングの内周面とライニング材がフィットするように指でリングに押しつけるが、その際、従来のセラミックシートは手触りが悪く操作性が悪かった。

【００１３】

【問題を解決するための手段】本発明の歯科鋳造用リングライニング材は、セラミック繊維を主成分とするシートの少なくとも片面に疎水性膜を設けることにより、セラミックシートの優れた耐熱性、クッション性と疎水性膜による確実な撥水性、表面平滑性を併せ持たるものである。

【００１４】基材となるセラミックシートについては、歯科鋳造ではワックスパターンを加熱脱ろうする際、電気炉で７００～８００℃で加熱するため耐熱性の骨材として、耐熱温度１０００℃以上のセラミック繊維を使用する。１０００℃以上の耐熱性を有する無機繊維としてはＡｌ２Ｏ３／ＳｉＯ２の重量比が０．４～０．６のセラミック繊維の他、アルミナ繊維、ジルコニア繊維、シラス繊維、チタン酸カリウム繊維を用いることができる。或いはこれに耐熱温度７００～８００℃のロックウールを配合しても良い。更に、加熱時、有機バインダの消失後の強度補強のためガラス繊維やアルミナ粉を代表とする無機粉体を配合しても良い。骨材となるセラミック繊維の配合量は３０重量部以上は必要である。

【００１５】作業強度を得るための有機バインダーとしては微細セルロース繊維、ＣＭＣ、ゼラチン等の親水性の天然バインダー及びアクリル樹脂、酢ビ樹脂等の疎水性の合成樹脂エマルジョンを使用することができるが、必要な作業強度が得られるバインダであれば特にこれらに限定されるものではない。特に柔軟なライニング材とするためには柔らかいバインダ、例えばＭＦＴ（最低被膜形成温度）が０℃以下のアクリルエマルジョンや可塑剤混合比が５０%程度の酢ビエマルジョンが適しており、その配合量は５～２０重量部が適当である。なお有機材料として合成樹脂と併用し、従来から使用されている天然パルプを配合して柔軟な風合いを出しても良い。

【００１６】前述のような材料配合で成形したシートの少なくとも片面に設ける疎水性膜としてはポリエチレン、ポリプロピレン、ポリスチレン、ポリ塩化ビニル、ポリ塩化ビニリデン、ポリビニルアルコール（疎水性）、フッ素樹脂、ポリカーボネート、アセテート、ポリエステル、ポリアミド等の疎水性合成樹脂フィルムを接着剤或いは熱融着によって貼り合わせても良いし、天然ゴムラテックス、合成ゴムラテックス、合成樹脂ラテックス等のペーストを塗布しても良い。製造面から言えば熱可塑性樹脂フィルムの溶融シートをセラミックシートに合わせ冷プレスで樹脂をフィルム化し貼り合わせるのが効率的である。また、組成から言えば、歯科鋳造では加熱脱ろう工程で有機分は焼失するため、その際、塩素ガス等の有害ガスを発生したり、異臭、多量の煙等を発生しないものが好ましい。疎水性膜の厚みは撥水性と平滑性を確保できる範囲で薄い方が良い。すなわち撥水性と平滑性以外の要件としては、ライニング材全体の柔軟性を阻害しないこと、基材となるセラミックシートのクッション性を最大限に活かすこと、焼却時の焼失分を極力少なくすることが重要であるため薄い方が良いが、貼り合わせ加工時にピンホールや裂け目等が発生しないよう５～３０μｍ程度が好ましい。また、前記疎水性膜はシートの片面だけでなく両面に設けるようして、どちらの面でもリング内周面とできるリバーシブルタイプのリングライニング材に構成しても良い。更にまた、前記疎水性膜を袋状に加工して、シートの端面をも被覆できるようにすれば、埋没材の水分がシートに浸入することを完全に防止でき、シート自体の吸水性、撥水性が問題とならないため、有機バインダの組成や付着量等の選択の自由度を広げることができる。

【００１７】

【作用】前述のような条件でシートを作製し、その少なくとも片面、つまり埋没材と接触する面に疎水性フィルムを設けたリングライニング材を使用すれば、リング内周面にフィットさせるために指で押しつける側の面にフィルムがあるため手触りが良く、操作性が良い。次に埋没材は混水比の変化が生ぜず、硬化膨張及び熱膨張を妨げない正確な歯科鋳造が行える。すなわち埋没材と接触する面に設けた薄い疎水性膜により確実且つ完全に埋没材泥中の水を遮断するためライニング材が吸水することなく混水比を変化させない。従って埋没材の硬化膨張率を正確に制御できる。またリングライナ、埋没材間に水分の移動がないため水浮き、へこみが発生しないため効率的な作業が行え、ワックスパターン上部の埋没材層破損の危険もない。埋没材の硬化膨張には基材となるセラミックシートの優れたクッション性と疎水性膜の平滑性により埋没材粒子の膨張を抑制することなく設計通りの膨張をさせることができる。また電気炉にてワックスパターンを加熱焼却する際にも、埋没材の加熱膨張を抑制しない。以上のように、本発明によるリングライニング材を使用すれば、作業性が良く、且つ正確な歯科鋳造が行える。

【００１８】

【実施例】次に、本発明の実施例を比較例と共に説明する。

（実施例１）セラミック繊維４０重量部、ガラス繊維２０重量部、アルミナ粉末３０重量部、クラフトパルプ（ＮＢＫＰ）１０重量部を水中で離解する。これにアクリル樹脂７重量部、更に高分子凝集剤を加え通常の方法で抄紙し、乾燥して厚さ０．６５ｍｍのシートを作製し

た。これを0．2%フッ素撥水剤溶液にディッピングし、乾燥した。次に得られたシートの片面に溶融ポリエチレンシートを合わせ冷プレスによりポリエチレンをフィルム化し、セラミックシートとポリエチレンフィルムを貼り合わせた。なお貼り合わせたポリエチレンフィルムの厚さは10μmであった。これをサンプルAとした。

【0019】（実施例2）セラミック繊維30重量部、ガラス繊維20重量部、アルミ粉末30重量部、クラフトパルプ（NBKP）20重量部を水中で離解する。これに微細セルロース繊維3重量部、更に高分子凝集剤を加え通常の方法で抄紙し、乾燥して厚さ0．65mmのシートを得た。次に得られたシートの片面に厚さ15μmのエチレン酢ビ共重合体フィルムを有機接着剤スプレーを塗布して貼り合わせた。これをサンプルBとした。

【0020】（実施例3）セラミック繊維60重量部、ガラス繊維20重量部、アルミナ粉末20重量部を水中で離解する。これに酢ビ樹脂15重量部、更に高分子凝集剤を加え通常の方法で抄紙し、乾燥して厚さ0．65mmのシートを作製した。次に得られたシートの片面に厚さ20μmの疎水性ビニロンフィルムを熱融着により貼り合わせた。これをサンプルCとした。

【0021】（比較例1）実施例1と同様の配合、手順により、厚さ0．65mmのシートを得、これをサンプルDとした。

【0022】（比較例2）実施例2と同様の配合、手順により厚さ0．65mmのシートを得、これをサンプルEとした。

【0023】（比較例3）実施例3と同様の配合、手順により厚さ0．65mmのシートを得、これをサンプルFとした。

【0024】次に得られた各サンプルをリングライニング材として使用し、乾式鋳造法及び湿式鋳造法の両方で鋳造し、埋没材の乾燥、凝結時の「水浮き」及び「へこみ」の程度を測定し、更に鋳造体の適合度を測定し適合の良、不良を評価した。更に各サンプルシート自身の吸水性（疎水性膜を有するものは、疎水性膜側の吸水性）も測定し、結果を表1に示した。尚、試験方法を下記に示す。

（1）サンプルを幅35mm、長さ89mmに裁断し、高さ35mm、内径29mmφの鋳造用リングの内側に裏装する。疎水性膜を設けたサンプルは、埋没材と接する側が疎水性膜となるようにする。湿式法で鋳造する場合は下記（3）で述べる埋没材注入の約1分前にリングごと水に1秒間浸漬し良く振って余剰水を切る。

（2）既成のクラウン型ワックスパターンを植立した円錐台に、サンプルを裏装した鋳造リングを固定する。

（3）更に、埋没材粉末と水を適正混合比となるように混合し、クリーム状に練り上げた埋没材をリング内に注入しワックスパターンを埋入する。なお、埋没材は混水比（水／埋没材）0．38の石膏系埋没材を使用した。

（4）リングに埋没材を注入してから乾燥するまでに要した時間（埋没材上部表面の水が消滅するまでの時間）を測定する。また、この時「水浮き」の有無を観察し、「へこみ量」はデブスメータにより測定する。

（5）適合性についてはA．D．A規格No．2にあるフルクラウン型及びMODインレー型を用い上記と同様の方法にて凝結硬化させ、十分乾燥した後、700℃で加熱焼却し歯科用金銀パラジウム合金を鋳造し室温まで冷却し、鋳型より取り出して原型に戻し、適合性の良、不良を評価する。

（6）シートの疎水性については、水平に置いたシートサンプルに0．5ccの水を滴下し、吸水して裏面に浸透するまでの時間を測定する。尚、疎水性膜を有するものは、疎水性膜側に滴下する。

【0025】

【表1】

		サンプル	フィルム	シートの吸水性（吸水時間）	埋没材凝結硬化特性				鋳造性
					鋳造法	乾燥時間（分）	へこみ量（mm）	水浮き発生の有無	適合性
実施例	1	A	10μm厚 ポリエチレン	30分以上	乾式	12	0	無し	良好
					湿式	12	0	無し	良好
	2	B	15μm厚 エチレン酢ビ	30分以上	乾式	11	1.0	無し	良好
					湿式	12	0	無し	良好
	3	C	20μm厚 ビニロン（疎水性）	30分以上	乾式	12	0	無し	良好
					湿式	12	0	無し	良好
比較例	1	D	無し	20分	乾式	12	1.5	無し	良好
					湿式	12	1.0	無し	良好
	2	E	無し	0（瞬時浸透）	乾式	4	6	無し	鋳型破損
					湿式	23	0	有り	良好
	3	F	無し	7分	乾式	6	7	無し	鋳型破損
					湿式	8	4	無し	良好

【００２６】上記の表１から明らかなとおり、本発明実施例の場合、乾式鋳造法、湿式鋳造法のいずれでも埋没材の乾燥、凝結硬化時の「水浮き」及び「へこみ」に問題なく、鋳造体の適合性も問題ないことが確認できた。それに対し疎水性膜を有しないものは、撥水性のサンプルDは「水浮き」もなく適合性も良好であるが、１．０～１．５ｍｍ程度の「へこみ」を生じた。また、吸水性の強いサンプルEは乾式鋳造法では「へこみ」が大きく鋳型破損を生じ、湿式鋳造法では「水浮き」が発生し、乾燥時間が長くなり作業性が悪いものであった。また、吸水性の弱いサンプルFは乾式鋳造法では「へこみ」が大きく鋳型破壊を生じた。

【００２７】

【発明の効果】本発明による歯科鋳造用リングライニング材はアスベストを全く含まず、セラミックシートの十分な耐熱性、クッション性と、疎水性膜の確実な撥水性、および平滑性を合わせ持つものである。疎水性膜によりリングへ装着する際の手触りが良く確実に埋没材泥中の水を遮断できるためライニング材が吸水することなく混水比を変化させず埋没材の硬化膨張率を正確に制御でき、水浮き、へこみも発生しない。また埋没材の硬化膨張時には基材となるセラミックシートの優れたクッション性と疎水性膜の平滑性により埋没材粒子の膨張を制御せず、更に加熱膨張時にも埋没材の加熱膨張を抑制せず鋳造修復物の欠損支台部への適合性も良好となる。このように歯科鋳造用ライニング材に要求される性能が従来のものより向上するという効果を有する。